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Systematic Review on Giloy (Tinospora cordifolia) and Its Applications

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Abstract : *Tinospora cordifolia (Giloy/Guduchi) is an important medicinal plant belonging to the family Menispermaceae which is widely used in Ayurveda under AYUSH system. This plant has various bioactive compounds like alkaloids, flavonoids, glycosides, tannins, saponins etc. It has various pharmacological properties like anti-diabetic, immunomodulatory, antioxidant, hepato protective, anti-inflammatory, anti-hypertensive and anti-cancerous activity. The major mechanism behind these activities is enhancement of insulin secretion, maintaining glucose metabolism and boosting immunity. Apart from its medicinal properties, this plant is also used as a functional food ingredient in form of juice, powder and decoction. Overall, this medicinal plant has lot of potential as a nutraceutical.*

Keywords: Tinospora cordifolia, Giloy, Ayurveda, Phytochemicals, Antidiabetic, Immunomodulatory, Antioxidant, Anticancer, Functional food, Nutraceutical

I. INTRODUCTION

Tinospora cordifolia belonging to the family Menispermaceae is an important medicinal plant in the traditional systems of medicine especially in Ayurveda. It is commonly known as Giloy in Hindi and Guduchi in Sanskrit. This plant is found abundantly in tropical regions of India.[1] This plant is highly versatile and widely known for its rejuvenating properties. The plant has been shown to exert Anti-diabetic, immunomodulatory, antitumor, antioxidant, antihypertensive, and hepatoprotective effects. [2] [3] [7] [11] [17] Guduchi (Giloy) has been reported to have beneficial effects in the treatment of heart diseases, diabetes, leprosy, arthritis and laxation of intestine and muscles. The plant's active constituents like phenols, flavonoids, tannins, cardiac glycosides, and saponins have been observed to have target-specific effects in diabetic conditions. Giloy's anti-diabetic effects can be seen due to the presence of alkaloids, cardiac glycosides, tannins, flavonoids, and saponins. [3] [4] [6] [8] Giloy is a large climber which grows on top of the tallest trees in the forest. They have many long twisting branches. On growing older, the branches grow aerial roots hanging downwards. These aerial roots are light grey-brown to creamy white in colour, very bitter in taste but odourless. The plant is commonly known as 'Guduchi Sava'. The stems are long, thin and fleshy. [5] [10]

It has been reported that Giloy has many phytochemicals with strong cytotoxic and immunomodulatory effects. These phytochemicals stimulate the immune cells and thus exhibit anti-tumor effects. The plant increases the phagocytic activity of macrophages and increase nitric oxide production. In ayurveda it is believed that taking Giloy with Jaggery will provide better therapeutic effects. It helps in treating many ailments and contribute to living longer. The stem of Giloy has been used traditionally to treat viral infections, fever, jaundice, emaciation, skin diseases, diabetes and anaemia. The proximate analysis was carried out using standard methods. The mineral content was analysed using an Atomic Absorption Spectrophotometer with an air-acetylene flame. Many important results were obtained after extensive phytochemical, pharmacological and clinical studies. [9]

India has a rich history of medicine with well-known systems like Ayurveda, Yoga, Unani, Siddha, Homeopathy, Sowa-Rigpa and Naturopathy falling under the umbrella of AYUSH. There are many traditional forms of medicine practiced in the country. Many of which are passed down orally from generation to generation and have not been

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documented. The Ministry of AYUSH, Government of India oversee specific councils for every medical system. Their job includes educating people about the system, carrying out research, regulating the system and creating awareness. [12] Giloy leaves have been known to have many therapeutic effects, especially aiding digestion. They are commonly used to treat ailments like acidity, gastroenteritis, parasitic infections, poor appetite, stomach upset, excessive thirst and nausea. It also helps in treating liver related ailments such as hepatitis. [13]

Nutritional Value of Giloy juice:-

The nutritional value of giloy juice (stem) is as follows :[15]

Nutrient Compound	Value
Protein	4.13gm
Fat	3.12gm
Fibre	16.19gm
Vitamin C	4.44mg



Fig: Different Parts of T. Cordifolia

Taxonomic classification Table:-

Different taxonomic ranks in the biological classification system :-

Taxonomic rank	Classification
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliophyta
Order	**Ranunculales**
Family	**Menispermaceae**
Genus	**Tinospora**
Species	**T. Cordifolia**

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Tinospora cordifolia (Willd.) Miers ex Hook. F. & Thoms belongs to family Menispermaceae. It is a large deciduous climber and is widely distributed in India. These plants are mostly cultivated in tropical regions of the country at an altitude up to about 300m above sea level. They are also found in some parts of China. They are usually planted during the months of monsoon, i.e., July to August. This plant grows well in medium black and red soils but can also be successfully grown in different types of soils including sandy and clay loamy soils.[16],[20]

Morphological and Physiological Characteristic:-

Morphological characteristics:-

Flower:

Male flowers are located in the axils of the leaves and have small bracteates. Female flowers are usually single with similar morphology to male flowers.

Sepals:

There are a total of six sepals. The outer three are small and ovate-oblong with acute apices, whilst the inner three are large, thin, broad oval and concave. They are yellow in colour and measure approximately 3-4mm.

Petals:

The flower consists of six petaloids. Each petaloid measures approximately 2mm and are long and broad spatulate. They encase the stamen in the early development stages. The claw is wedge shaped and the lobe is triangular or slightly trilobed with reflexed apices.

Trunk:

The trunk is corky and has slender hanging branches which produce fleshy roots. The trunk is cylindrical, furrowed, pale, tuberous and has a bitter taste.

Leaf:

The leaves are thin and have between 7-90 veins. They measure usually 5-10cm but can measure up to 12x10cm. The leaves are globose/deltoid with wide sinus and prominent bases. The apices can be obtuse or slightly acute. The veins are shiny under microscopic examination due to the presence of glands.

Fruit:

The fruit is fleshy, smooth and is coloured between orange and red. It has no drupelets and is on a thick stalk. The style scars are visible. The fruit develops in winter.

Habitat:

This plant is commonly found throughout tropical areas of India. It can be found at heights of up to approximately 1000ft.

Plant Part used:

The whole plant is used in traditional medicine. Different parts of the plant such as roots, bark and leaves from trunk are used for various ailments. It is known as Murakkabul Quwa and was described by Hakim Abdul Hakim as having a Barid Yabis temperament.

Dosage:

Classical texts suggest taking 4-9g per day orally. The Unani Pharmacopoeia suggests taking 5-10g per day.

Side effects: No side effects have been reported in classical texts.

Treatment:

If there are any side effects then they can be treated using Tabacia and Danaheal.

Substitute:

Sategi Roy can be used as a substitute.[20][22]

Physical Description:-

•Perennial climber up to 20m in length.

•Thick, woody stem, cylindrical and hollow.

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•Simple alternate leaves. The leaves are heart shaped with acute apices. They measure approximately 8-10cm in length and 5-6cm in width.
•Small greenish-yellow flowers.
•Oval greenish-yellow fruits measuring approx 2-3cm.[20]

Active Constituents of Giloy:-

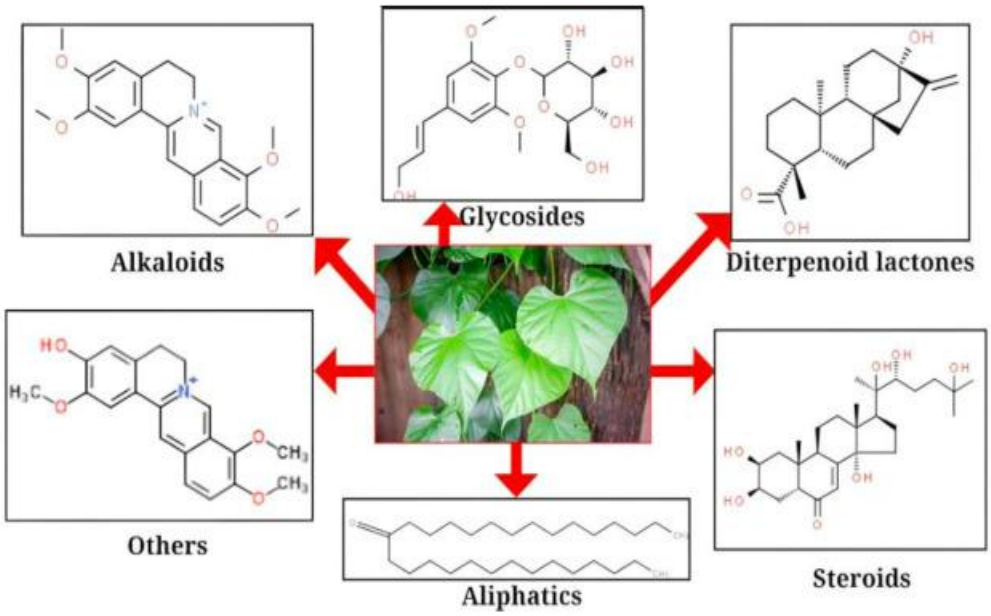


Fig: Active compounds from Tinospora cordifolia

Active constituents of Giloy with Biological Response:

Sr. No.	Types of components	Compounds	Source (plant Parts)	Biological Response
1.	Alkaloids	Berberine,Tinosporin, Isocolumbin, Choline, Palmatine, Tembetarine, Magnoflorine	Stem,Root	Exhibits anticancer, antiviral, antidiabetic properties and helps in neurological disorders
2.	Glycosides	Tinocordiside, Cordioside	Stem	Useful in managing neurological disorders such as Parkinson's disease
3.	Diterpenoid	Furanolactone	Whole plant	Shows vasorelaxant, anti-inflammatory, antimicrobial, antihypertensive, and antiviral effects
4.	Steroids	β-Sitosterol	Stem, aerial parts	Helps induce bone-related changes during early inflammatory arthritis
5.	Aliphatic	Octacosanol	Whole plant	Possesses anti-

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	compound			nociceptive and anti-inflammatory activities
6.	Others constituents	Giloin, Tinosporic acid	Root	Used for anxiety management and exhibits protease-related activity

Tinospora cordifolia contains a variety of bioactive compounds. Alkaloids, glycosides, aliphatic, steroids, sesquiterpenoids, polysaccharides, diterpenoid lactones and phenolic compounds have been isolated from the plant. The leaves of the plant are rich in proteins and contain essential minerals such as phosphorus and calcium. The plant contains various phytoconstituents such as glycosides, alkaloids, bitter principles and crystalline compounds. The main bitter principles found are columbin, chasmanthin and palmarin.[14],[19],[21],[24],[25]

Application of Giloy in the Human Diet :-

There are different ways in which you can take Giloy:

Giloy Juice: Fresh juice can be taken to assist the body in fighting infection such as Dengue. It helps boost immunity.

Giloy Powder: This is used as a natural health booster and is typically taken with warm water.

Giloy Kadha: Giloy can be added into herbal Kadhas with other herbs such as Ashwagandha and Ginger.

Giloy Paste: Leaves can be mashed to create a paste that can be used externally to help improve skin conditions or aid healing of wounds.[16]

History and traditional usages:-

History:-

T. Cordifolia (TC) is one of the important medicinal plants mentioned in ancient Ayurvedic literature. This plant was first mentioned around 3000 BCE. [13] It can be found in classical texts like Charaka Samhita, Sushruta Samhita and Ashtanga Hridaya. Later texts like Bhavaprakasha and Dhanvantari Nighantu also mention this plant. It is referred to by many names like Amara, Amritavalli, Chhinnaruha, Chhinnodbheda and Vatsadani in these texts. [7] Tinospora is a deciduous glabrous perennial creeper which is distributed across India. The plant grows in tropical regions up to an altitude of around 1.2 km. It can also be found in nearby countries like China, Sri Lanka, Bangladesh, Pakistan and Burma (Myanmar). [19]

Recently Giloy has become popular globally for its immunity boosting properties. During the time of the COVID-19 pandemic, it has been encouraged for use in traditional health care by organisations like the Ministry of AYUSH.

Taste: Bitter and Astringent.

Properties: Light and Easily Digestible.

Potency: Hot.

Post-digestive Effect: Post digestion it has a sweet metabolic effect. [12]

Traditional Uses :-

Traditionally Giloy is used to treat-

•Fever (especially chronic and recurring)

•Improve immunity and increase strength.

•Manage Diabetes (Madhumeha)

•Relieve indigestion, acid reflux and loss of appetite.

•Manage skin disorders and help with healing wounds.

•Good for respiratory problems like cough and Asthma.

•Helps to detoxify the body and support liver health.

•Reduce inflammation in disorders like Arthritis and Gout.

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Some of the significant formulations include...

Guduchyadi Churna, Guduchi Taila, Dashmoolarishta, Sanjivani Vati, Kantakari Avaleha, Chyavanprash, Kashaya Churna, Panchanimba Churna, Guduchi Ghrita, Amrita Guggulu and Amritashtaka Churna are the formulations of Ayurveda that are frequently used in traditional medicine.[7]

Consumption of Giloy in the Human Diet:-

Giloy can be incorporated into the human diet in different ways, including:

•Juice :

Consuming fresh Giloy juice can boost your immune system and assist your body with fighting off illnesses such as Dengue.

•Powder:

Giloy can be taken in powder form. Mix the powder into warm water to improve immune function.

•Kadha:

Giloy can be mixed into a traditional herbal Kadha containing ingredients such as ginger, ashwagandha and other medicinal herbs.

•Paste:

A paste can be made using Giloy leaves. This can be applied to the skin externally to help promote wound healing and improve skin conditions.

•Capsules:

Giloy can also be taken in capsule form which is useful for those who do not like its taste. One capsule a day is typically taken to help support immunity. [20]

• Pharmacological Activity Of Giloy Plant:-

The pharmacological activities of Tinospora cordifolia have shown its therapeutic importance in Ayurveda. Also referred to as Giloy,it acts as a good herb for reproductive system, purifying the blood and fat metabolism. Traditionally it is used for treating many diseases like gout, jaundice, tuberculosis, etc. Many of the traditional uses are now scientifically proved. [22]

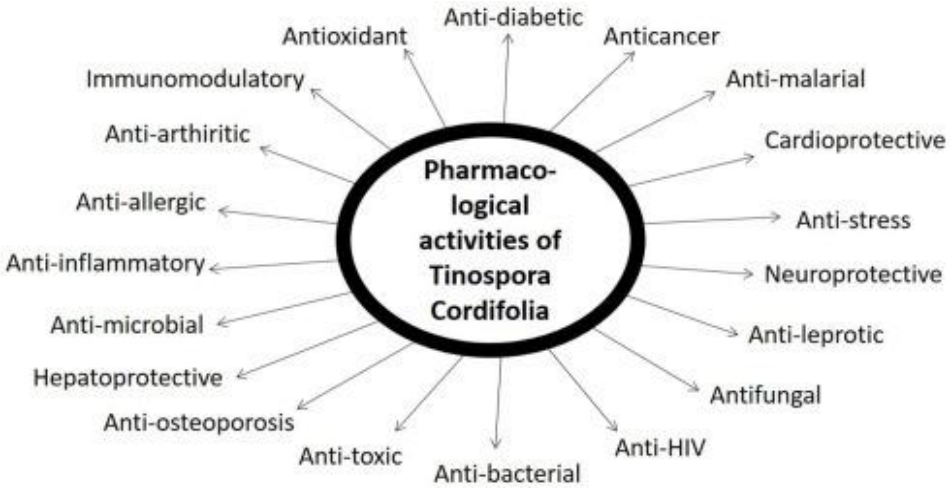


Fig:- Therapeutic potential of Tinospora cordifolia in pharmacology.

Anti-diabetic:-Tinospora cordifolia is widely used in Ayurveda to manage diabetes mellitus. This herb is commonly known as Giloy, which is also called Madhunashini (destroyer of sugar). It is believed to increase the secretion of insulin thus helping to control the blood sugar level. Various studies have shown how beneficial this herb can be in

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decreasing various experimental complications of diabetes such as neuropathy and gastropathy. [7],[23] Tinospora cordifolia has hypoglycaemic properties that helps decrease the sugar levels in people suffering from diabetes. The juice of Giloy helps diabetic patients by decreasing the lipid levels and the complications caused due to neuropathy. It helps to regulate the sugar levels in blood by increasing secretion of insulin, decreasing gluconeogenesis and glycogenolysis. [14] Tinospora cordifolia contains many phytoconstituents like alkaloids, tannins, cardiac glycosides, flavonoids, saponins, and steroids. These are known to show very good anti-diabetic activity especially in managing type 2 diabetes. [16],[26] The crude stem extract obtained by using solvents like ethyl acetate, dichloromethane, chloroform and hexane decreases the activity of postprandial enzymes such as salivary amylase and α-glucosidase thereby decreasing the digestion of carbohydrates. [18] Extracts of Tinospora cordifolia have been found to work on various sites like liver, adipose tissue, pancreatic β-cells, intestinal mucosal L-cells and skeletal muscles. This herb works by extra-pancreatic (predominantly) and intra-pancreatic mechanism to provide various therapeutic effects. [21]

Mechanisms of Action Of Giloy :-

Giloy (Stem/Extract)
↓
Presence of Bioactive compounds
(Alkaloids, Flavonoids, Saponins, Glycosides and Tannins)
↓
Pancreatic mechanism
↓
Stimulation of pancreatic β-cells
↓
Increased Insulin secretion
↓
↓ Blood glucose level

Marketed Products:-

1) Patanjali Giloy Ghanvati (Tablet)
   1-2 tablets twice a day with warm water.

2) Dabur Giloy juice (Juice)
   10-20ml once/twice a day with water before meals.

3) Baidyanath Giloy Sat (Powder/Satva)
   250-500mg twice a day.

2) Anticancer :-

This plant exhibits strong anti-cancerous properties against various types of cancers by destroying the cancerous cells and preventing skin carcinogenesis.[7] In some studies of cancer, Tinospora cordifolia (Giloy) showed better results than Doxorubicin. Giloy prevents proliferation of oral cancer cells in a dose dependent manner by increasing the process of apoptosis (Programmed cell death) and decreasing epithelial-mesenchymal transition.[14]

Tinospora cordifolia (Giloy) has shown better results than Doxorubicin in some cancer related studies. It prevents proliferation of oral cancer cells in a dose dependent manner by causing apoptosis (Programmed cell death) and decreasing epithelial-mesenchymal transition.[15],[16]

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Mechanism of Action :-

Phytochemicals from Giloy
↓
Immune Stimulant
↓
Cancer Cell Apoptosis
↓
Tumor Inhibition
↓
Anti-Cancerous Effect

Marketed Products :-
1)Dabur Giloy Ghanvati – Take 1-2 tablets two times a day.
2)Kapiva Giloy Juice – Take 10-20ml two times a day.
3)Patanjali Giloy Ghan Vati – Take 1-2 tablets two times a day.

3) Antimalarial :-
The plant extracts of Tinospora cordifolia (TC) have various pharmacological actions like hypoglycaemic, CNS depressant effect and muscle relaxant. The therapeutic effects are mainly due to the root of plant. It is used traditionally for treating malaria, cough and leprosy. Decoction is taken orally to help abdominal pain caused by indigestion and dysentery, to reduce spleen enlargement, heal skin disorders and also as a diuretic.[28]

Mechanism of Action :-Tinospora cordifolia
↓
Active Phytochemicals
↓
Activates Insulin → Hypoglycaemic effect
↓
Activate immune cells → Immunomodulator
↓
Central nervous system ↓ → Sedative effect
↓
Anti-inflammatory effect
↓
Diuretic effect (Increased Urine)
↓
Used for treating Malaria, cough, stomach ache, Skin disorder.

Marketing products:-1) 10-20ml of Giloy juice – 2 times a day.
2)1-3g Giloy Powder – daily.

Antioxidant:-
A significant increase in TBARS [Thiobarbituric Acid Reactive Substances] was found in the brain and decreased in the heart of diabetic rats. The administration of Tinospora cordifolia improves antioxidant defence system by increasing the regulation of glutathione reductase (GSH), and increasing the activity of antioxidant enzymes like superoxide dismutase (SOD), catalase, glutathione peroxidase (GPx) in the tissues of diabetic rats. Oral administration of T.

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Cordifolia alcoholic root extract at a dose of 100 mg/kg for 6 weeks helps in restoring the antioxidant status of heart and brain. [27]

Mechanism of action :- Tinospora cordifolia extract

↓

Reduces Oxidative stress

↓

Increase SOD, Catalase, GPx, GSH

↓

Decreases TBARS

↓

Restores antioxidant status in heart & brain.

Anti-HIV:- Tinospora cordifolia has been studied to improve antiretroviral therapy in HIV positive patients. In reducing drug resistance in retroviral treatment, this herb may help increase the effectiveness of antiretroviral agents. The anti-HIV effects of this herb assist in managing the disease as it increases the number of CD4 T-cells and decreases eosinophils (white blood cells), therefore improving the immune response in HIV positive patients.[29] This anti HIV effect was seen due to decrease in number of eosinophils, increased activity of B Lymphocytes, macrophages, haemoglobin and polymorphonuclear leucocytes. [25]

Mechanism of Action :- Tinospora cordifolia

↓

Immunomodulation

↓

↑CD4 T-cells ↓Eosinophils

↓

Improves immune response in HIV patients

Marketed products :-1)Zandu Giloy Tablets – Take 1 tablet twice daily
2)Patanjali Giloy Ghanvati – Take 1-2 tablets twice daily
Marketed product :-1)Zandu Giloy Tablets – 1 tablet twice daily
2)Patanjali Giloy Ghanvati – 1–2 tablets twice daily
•Health Benefits :-
•Control of blood sugar
•Increased immune system
•Improved digestion
•Reduces stress & anxiety
•Improves vision
•Improves breathing
•Treatment of arthritis and gout
•Used in Hay fever [27]

Future Prospect:
Herbal Formulations: Development of tablets, capsules, syrups, and herbal extracts.
Antidiabetic Research: Further studies on blood glucose regulation and insulin secretion.
Immunomodulatory Activity: Investigation of its effects on immune system function.

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Antioxidant and Anticancer Research: Further laboratory and clinical studies to evaluate its therapeutic potential.
Nutraceutical Development: Use in herbal beverages, functional foods, and health supplements.
Advanced Drug Delivery: Exploration of nanotechnology to improve the delivery of active compounds.
Quality Control: Standardization of phytochemicals using HPLC and HPTLC techniques.
Safety Studies: Clinical trials to evaluate efficacy, dosage, side effects, and liver safety.
Sustainable Cultivation: Improved cultivation and conservation methods.

II. CONCLUSION

Tinospora cordifolia (Giloy) is a very valuable medicinal plant having various therapeutic applications. The plant possesses various biologically active compounds like alkaloids, glycosides, flavonoids, steroids etc which makes it possess various therapeutic effects like anti-diabetic, anti-cancerous, anti-malarial, anti-oxidant, immunomodulatory activity. Traditionally, in Ayurveda it has been used for treatment of fever, diabetes, liver disease, infection and other disease related to immunity. Various scientific evidence is also available supporting the traditional claims. Hence this plant is an important herbal drug. It is also available in various marketed forms and is less toxic, therefore increases its therapeutic value. Thus this plant can be considered as a good natural medicine for prevention as well as treatment of various diseases and for overall health.

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